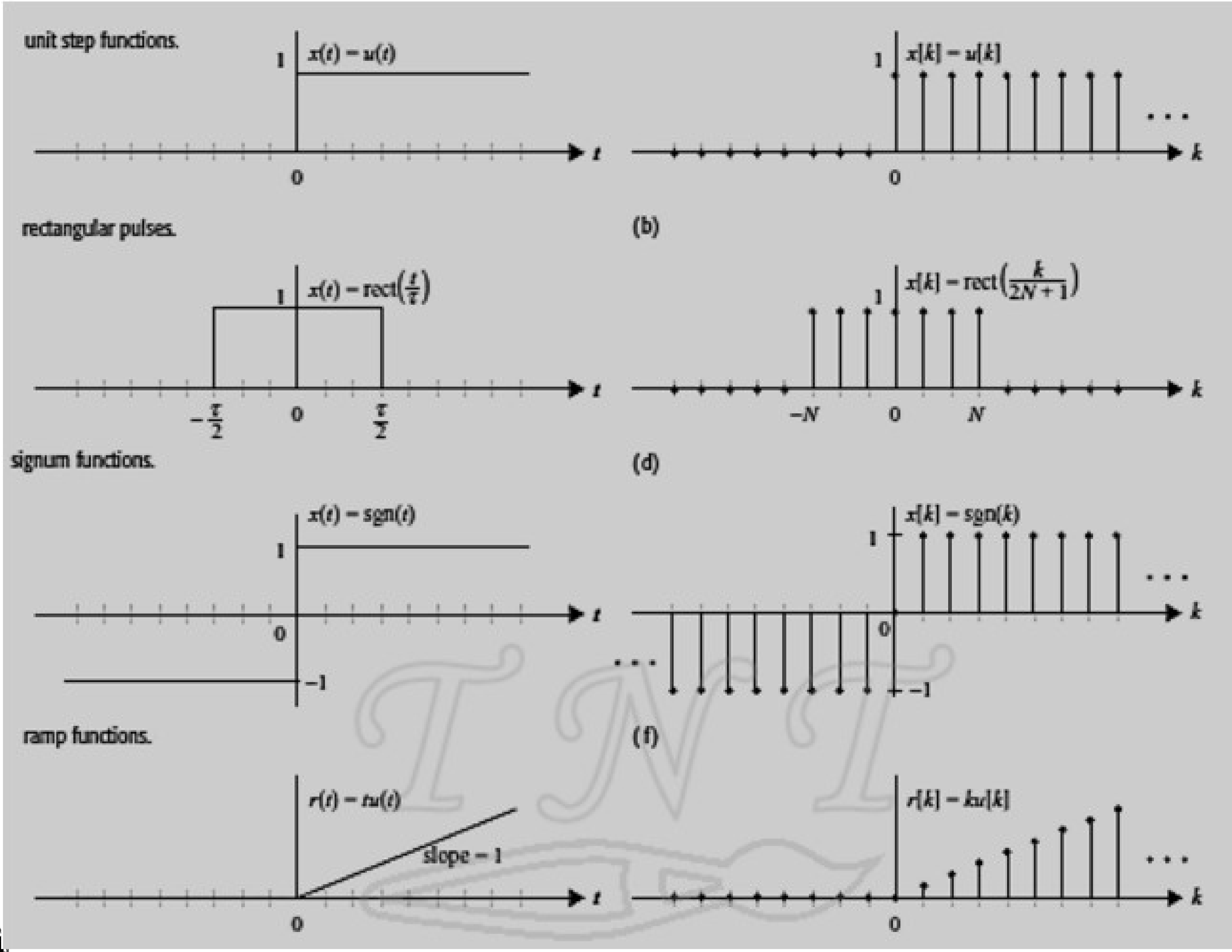
II – Espectros
Tabelas

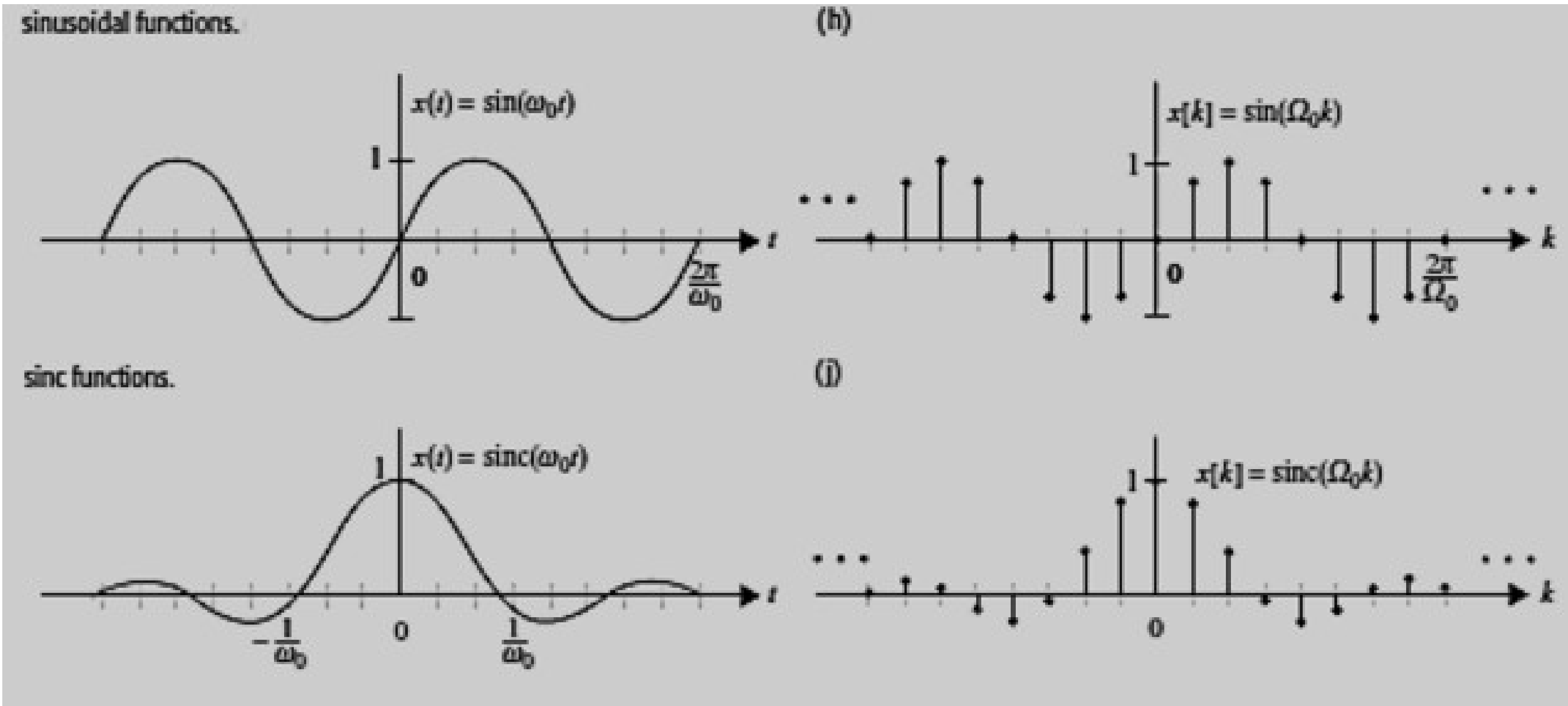
Processamento Digital de Sinais

2016/17 © ISEL-DEETC
André Lourenço
GonçaloMarques
Isabel Rodrigues

Alguns sinais mais comuns em PDS

Name	Continuous	Discrete
Unit Step function	$u(t) = \begin{cases} 1, & t \geq 0 \\ 0, & t < 0 \end{cases}$	$u[n] = \begin{cases} 1, n \geq 0 \\ 0, n < 0 \end{cases}$
Ramp signal	$r(t) = \begin{cases} t, & t \geq 0 \\ 0, & t < 0 \end{cases}$	$r[n] = nu(n) = \begin{cases} n, n \geq 0 \\ 0, n < 0 \end{cases}$
Impulse function	$\delta(t) = 0, t \neq 0$	$\delta[n] = \begin{cases} 1, n = 0 \\ 0, otherwise \end{cases}$
Rectangular pulse function	$rect\left(\frac{t}{\tau}\right) = \begin{cases} 1, \lvert t \rvert \leq \tau/2 \\ 0, \lvert t \rvert > \tau/2 \end{cases}$	$rect[\frac{n}{2N}] = \begin{cases} 1, \lvert n \rvert \leq N \\ 0, \lvert n \rvert > N \end{cases}$
Triangular pulse	$tri\left(\frac{t}{\tau}\right) = \begin{cases} 1 - \lvert\frac{t}{\tau}\rvert, t \leq \lvert\tau\rvert \\ 0 \quad , t > \lvert\tau\rvert \end{cases}$	$tri[\frac{n}{N}] = \begin{cases} 1 - \frac{\lvert n \rvert}{N}, \lvert n \rvert \leq N \\ 0 \quad , elsewhere \end{cases}$
Signum signal	$Sgn(t) = \begin{cases} 1, t > 0 \\ -1, t < 0 \end{cases}$	$Sgn[n] = \begin{cases} 1, n > 0 \\ -1, n < 0 \end{cases}$
Sinusoidal signal	$x(t) = \sin(2\pi f_0 t + \theta)$	$X[n] = \sin(2\pi f_0 n + \theta)$
Sinc function	$\text{sinc}\ (\omega_0 t) = \frac{\sin(\pi\omega_0 t)}{\pi\omega_0 t}$	$\text{sinc}\ [\omega_0 n] = \frac{\sin(\pi\omega_0 n)}{\pi\omega_0 n}$


unit step functions.
$x(t) = u(t)$
$x[k] = u[k]$
(b)
rectangular pulses.
$x(t) = \mathrm{rect}\left(\frac{t}{\tau}\right)$
$-\frac{\tau}{2}$
$\frac{\tau}{2}$
$x[k] = \mathrm{rect}\left(\frac{k}{2N+1}\right)$
$-N$
N
(d)
signum functions.
$x(t) = \mathrm{sgn}(t)$
$x[k] = \mathrm{sgn}(k)$
(f)
ramp functions.
$r(t) = tu(t)$
slope = 1
$r[k] = ku[k]$


sinusoidal functions.
(h)
x(t) = sin(ω0t)
x[k] = sin(Ω0k)
sinc functions.
(j)
x(t) = sinc(ω0t)
x[k] = sinc(Ω0k)

Algumas

Tabelas úteis

Definições

$$\mathrm{sinc}(t) = \frac{\sin(\pi t)}{\pi t}$$

$$\omega_0 = \frac{2\pi}{T_0} = 2\pi f_0$$

$$X_k = \frac{1}{T_0} \int_{T_0} x(t) e^{-jk\omega_0 t} dt$$

$$x(t) = \sum_{k=-\infty}^{\infty} X_k e^{j2\pi k f_0 t} = \sum_{k=-\infty}^{\infty} X_k e^{jk\omega_0 t}$$

Sinal Periódico	Coeficientes da série de Fourier
$x(t)=\sum_{k=-\infty}^{\infty} X_k e^{jk\omega_0 t}$	$X_k=\frac{1}{T_0}\int_{T_0} x(t)e^{-jk\omega_0 t}dt$
$x(t), y(t)$ periódicos período T_0	X_k, Y_k
$ax(t)+\mathrm{b}y(t)$	$\mathrm{a}X_k+\mathrm{b}Y_k$
$x(t-t_0)$	$X_k e^{-j\omega_0 k t_0}$
$e^{j\omega_0 k_0 t}x(t)$	X_{k-k_0}
$x(-t)$	X_{-k}
$x(t)*y(t)$	$X_k Y_k$
$x(t)y(t)$	$X_k * Y_k$
$\frac{dx}{dt}$	$jk\omega_0 X_k$

$\boldsymbol{x(t)}$ **sinal real**	$\begin{cases} X_k = X^*_{-k} \\ \mathrm{Re}\{X_k\} = \mathrm{Re}\{X_{-k}\} \\ \mathrm{Im}\{X_k\} = -\mathrm{Im}\{X_{-k}\} \\ \lvert X_k \rvert = \lvert X_{-k} \rvert \\ \arg\{X_k\} = -\arg\{X_{-k}\} \end{cases}$
Potência de um sinal periódico	$P_x = \frac{1}{T_0} \int_0^{T_0} \lvert x(t) \rvert^2 dt$
Teorema de Parseval	$\frac{1}{T_0} \int_0^{T_0} \lvert x(t) \rvert^2 dt = \sum_{k=-\infty}^{\infty} \lvert X_k \rvert^2$